# AGRICULTURAL NEWS L

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This publication contains information regarding the development of European agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigations at agricultural experiment stations and other institutions on subjects of the Company's products and other subjects of agricultural interest.

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# AGRICULTURAL NEWS LETTER

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L. F. Livingston, Manager

William H. Lander
Editor

## AGRICULTURAL NEWS LETTER AVAILABLE ON MICROFILM

Several libraries, in the United States and abroad, have recently asked us for old numbers of the AGRICULTURAL NEWS LETTER which we were unable to supply. While we felt complimented on the fact that these institutions sought to keep their collections complete, there was nothing we could do about it simply because our stocks of the particular issues desired were exhausted.

The problem for those who collect the AGRICULTURAL NEWS LETTER, beginning with Volume 17, No. 1, of January-February, 1949, will be much simpler. University Microfilms, of 313 North First Street, Ann Arbor, Michigan, has the whole 1949 set on microfilm. It comes in a small box, which takes up little room. It can be read on various viewers now on the market. The 1949 collection is now being distributed. It is planned to have the 1950 volume ready by July 1951.

Those desiring to get the AGRICULTURAL NEWS LETTER on microfilm should send their orders direct to University Microfilms at Ann Arbor, Michigan. The price is $1.50 per volume, plus 10 cents for packing and mailing.

## LARGE QUANTITIES OF AGRICULTURAL BY-PRODUCTS USED IN MAKING NYLON

Now and again research is successful in finding valuable use for materials which previously had little or no value. When this happens, finished products can be produced and sold cheaper, and business activity springs up where nothing existed before.

A demonstration of this is the $34,000,000 contract Du Pont has signed with Quaker Oats to buy, over the next 10 years, 400 million pounds of furfural. Furfural, a nylon intermediate, is made from corn cobs and other agricultural by-products.

The Electrochemicals Department, in its furfural research program, is developing new lines of chemicals. One is tetrahydrofuran, which has been shown to be a superior solvent for polyvinyl chloride used in the finishing of upholstery material. Another is furan, which is being evaluated as an intermediate in the manufacture of agricultural chemicals. A third is dichlorobutane, which has already been sold in tank car quantities for manufacture of a new chemical product by another company.

## FACILITIES FOR RESEARCH IN ANIMAL MEDICINE, NUTRITION TO BE INCREASED

Plans to expand its research facilities in the field of animal medicine and nutrition have been announced by the Du Pont Company.

Four modern buildings are to be erected at Oakland, a 291-acre farm which Du Pont acquired near Newark, Del., in 1948 for this purpose. The job is expected to take about a year.

Du Pont's Grasselli Chemicals Department first entered the field of research in animal medicine and nutrition in 1945. The original work was done in a small building on the campus of the University of Delaware, at Newark, and has continued there and in a large farm house at Oakland.

### New Synthetic Chemicals To Be Tested

The new research facilities have been named "The Stine Laboratory", in honor of Dr. Charles M. A. Stine of Wilmington, a director of the Du Pont Company, who directed the research activities of the Chemical Department from 1924 to 1930. As a vice president from 1930 until his retirement in 1946, Dr. Stine actively sponsored Du Pont's research in the agricultural and veterinary fields.

The four principal buildings will be of brick construction and all will be single story structures. One will be a service building, and three will be devoted to research on nutrition, biology, and animal diseases. They will be air-conditioned throughout. There will also be a power-house and incinerator. Costs of this expansion, including equipment, are estimated at about $2,700,000.

Oakland is about three miles from Newark, Del., and 16 miles from Wilmington. It is on the Newark-Elkton road, and both the Mason-Dixon and the Delaware-Maryland border lines run through the property. The new buildings will all be in Delaware.

## Varied Research Work in Agricultural Chemicals

The work of The Stine Laboratory is directed toward the application of new synthetic chemicals to the control of bacterial and virus diseases, as well as the many parasites and insects which affect the health of domestic animals. Equal emphasis is placed on the study of animal nutrition. The Grasselli Department has two other agricultural research centers in the vicinity of Wilmington -- the Pest Control Research Laboratory, and a laboratory with greenhouses and test plots at Minquadale, Del.

At the Pest Control Laboratory, major attention is given to the application of chemicals to biological problems. Studies directed to the control of plant diseases and pests there have resulted in such important discoveries as the value of methoxychlor as an insecticide, and the effectiveness of 2,4-D as a selective weed killer. Of equal importance to agriculture have been the development of zinc and ferric dithiocarbamate salts as fungicides, and the application of dithiocarbamic acid derivatives as seed-treating agents.

## Cooperation Between Scientists

These developments have been achieved through the close cooperation of biologists with chemists especially trained in organic synthesis and the formulation of new biologically active materials.

Research at the Minquadale Laboratory is devoted chiefly to work on seed and soil disinfectants and chemical weed control.

In addition, the Grasselli Department has an experimental farm at San Jose, California, and has field research men located at strategic points throughout the country working in close cooperation with academic investigators and government experiment stations.

## METHOXYCHLOR AND LINDANE COMBINED IN NEW INSECTICIDE FOR DAIRY BARNS

A new insecticide, designed especially for use in and around dairy buildings, has been developed by the Du Pont Company. This new product -- Du Pont Dairy Barn Insecticide -- now makes possible a complete fly control program for dairy farms through use of just two spray materials.

Both barns and cattle must be sprayed to make such a program effective, Du Pont entomologists point out. Use of the new insecticide in barns, combined with applications of the currently recommended methoxychlor sprays on cattle, will achieve this result. Such a program will combine complete safety from toxic hazards with long residual protection of cows and premises.

The new insecticide for dairy barn use is a combination of two modern chlorinated hydrocarbon compounds -- methoxychlor and lindane. It was developed to give dairymen quick kill of flies, and also to keep barns fly-free for a number of weeks following each spraying.

### Both Chemicals Approved for Dairy Barns

Both these chemicals have been approved by the U. S. Department of Agriculture for fly protection in dairy barns. When used properly, these materials do not contaminate milk. Combined in the proper proportions, the two chemicals supplement the effectiveness of each other.

Dairy fly control problems have been complicated by the appearance of strains of house flies that seem resistant to certain insecticides, and by the discovery, by U.S.D.A. investigators, that some insecticides tend to show up in the milk and should not be used around dairy operations. Search for a

product for barn use which would help dairymen solve these problems resulted in the development of the lindane-methoxychlor insecticide.

Tests during the 1950 fly season, both at college experiment stations and on dairy farms throughout the country, were carried on to check the efficiency of the new insecticide. When applied as directed, it was reported to give outstanding control of flies under a wide range of operating conditions, and to remain effective up to eight weeks or longer.

The new product may be used for occasional application to dairy cattle to control mange and lice. It is not recommended for fly control on animals, however, due to the presence of lindane, which is considered too hazardous to the health of milk consumers for safe use at frequent intervals.

## House and Horn Flies Constitute Problem

Barn spraying is necessary, the Du Pont investigators pointed out, to eliminate the house fly -- a serious sanitation problem around dairies. Horn flies, on the other hand, may cause a drop in milk production of as much as 20 per cent through biting the cattle and keeping them from grazing. Since these horn flies spend their lives on the animals, they can only be controlled through spraying the cows.

Du Pont Dairy Barn Insecticide is a wettable powder. It is packaged in one-pound cans and four-pound bags, with a pound of material in three gallons of water recommended for every 1,500 square feet of surface to be sprayed.

The approved material for spraying cattle is offered as Du Pont Dairy Cattle Spray in a variety of package sizes. It is also a wettable powder, with a pound in 12 gallons of water sufficient to treat 25 head. This spray is a 50% formulation of methoxychlor, which has been officially approved for use on cattle because of its low toxicity and because it has little or no tendency to appear in the milk of animals treated as directed. Many toxicological tests have been made on this product to determine its degree of safety to animals and humans.

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## DISSENSION IN BUSINESS MACHINE COULD GREATLY HELP ENEMIES OF DEMOCRACY

Dissension created in the American business machine by false claims that big business gets most of the benefit from defense contracts helps only the enemies of democracy, Henry B. du Pont, a vice president of E. I. du Pont de Nemours & Company, said in a speech at the annual banquet of the Tulsa, Oklahoma, Chamber of Commerce recently.

The industrial system spreads the work "far more thoroughly than the government itself is able to do," he said, pointing out that in the last war the small firms showed a greater increase in sales, profits, and growth than the big companies.

The American business system is "a working partnership of interdependent business units," Mr. du Pont continued. "It is the system on which our strength as a producing nation must rest both in war and in peace."

"If I were a Communist spy, assigned by the Kremlin to come over here and head up a program to do the maximum harm to the United States," he said, "I would plan a subtle campaign to turn the public against the American business system and to create dissension in the business machine itself, so that the various elements would begin to quarrel with each other instead of being partners and team-mates."

### Long-Term Effect of Sabotage Serious

"That is the kind of sabotage which can do the greatest damage, and its long-term effect is far more serious," he declared.

"It would be very effective if I could influence small businessmen and people in various walks of life to become increasingly suspicious of the big business units. It would be most gratifying if these suspicions could be turned into political issues which would react to the disadvantage of large companies and result in oppressive taxation and discriminatory regulations for the big concerns and the government ownership of important industries."

"What greater gift could a good Communist saboteur send to his home office?" he asked.

The way to bring this about, he said, "would be to collect a lot of the old lies and falsifications about big business and induce as many groups of people as possible to believe they were true."

### Communists Want to Weaken U. S.

He pointed out that many sincere Americans are critical of big business, so an undercover organization would give them support and encouragement to spread the propaganda. They are not Communists, but the Russians do not care, he said.

What the Communists want, Mr. du Pont declared, "is to have the United States weakened and they know it can be accomplished more quickly and easily by influencing loyal Americans to become misguided in their thinking and adopt measures that would put our country in the same plight as Great Britian's."

The stories a saboteur would spread "sound very plausible," he noted, "for instance, that big companies are bent on driving the little fellows out of business; that they arbitrarily fix prices; that they suppress inventions; that they make exorbitant profits; that they hold the power of life and death over small business."

"Then, if this program of propaganda resulted in legislation to break up large units of American business and to provide for government ownership of basic industries, think of the delight back in the Kremlin," he said.

## Large and Small Businesses Have Same Interests

"Neither the objectives nor the interests of the large business and the small should at any time be opposed," Mr. du Pont declared. "Working closely together, each contributes, each benefits, and each profits."

During the last war, the Du Pont Company did about one billion dollars worth of military construction and about 56 per cent of that cost went to pay for materials and services supplied by other firms, he pointed out. "We used about 1500 sub-contractors, who supplied services of a type that they could do and we could not."

Noting the effort of the government to get contracts to small companies, Mr. du Pont declared, "the operation of our American business system spreads the work among small business units far more thoroughly than the government itself is able to do."

"I don't think you can show that the big firms took advantage of the small or that the small were shouldered out of the way in the pay line," he declared. "Rather, all of us lined up together and did the job together as a team."

## Economic Freedom is Great Incentive

"What is it that has enabled American industry to continually pull rabbits out of its hat and then achieve a rate of production greater even than that of the rabbits?" he asked.

"The answer lies in the conditions under which our industry has developed," he asserted. "Under the traditional American system, we have enjoyed a measure of economic freedom unknown in other nations."

## TEXAS TESTS SHOW POSSIBILITIES OF MESQUITE CONTROL WITH NEW CHEMICAL

New evidence that aerial sprays of 2,4,5-T are effective for mesquite control has been reported by plant scientists of the United States Department of Agriculture and the Texas Experiment Station. The results were announced after tests were carried out at Spur, Texas.

2,4,5-T, like its chemical cousin 2,4-D, is a plant hormone which also has properties of a weed-killer. The T in 2,4,5-T stands for Trichlorophenoxyacetic acid. Since it is not a selective herbicide, Du Pont has always recommended that care be taken to avoid airplane sprays drifting to cotton or to other crops in the areas where it is used.

The findings of the Texas experiments indicate that 2,4,5-T is effective as a mass method of fighting mesquite in the Southwest range country at a comparatively low cost. These experiments also hold possible clues to control methods for mesquite in other environmental conditions where it thrives and for other species of brush.

### May is Good Month for Spraying

The experiments at Spur with mesquite showed that it can be killed by aerial sprays of 2,4,5-T applied late in May, when the brush is in vigorous growth. The treatment is similar to that in which 2,4-D is now used to control sagebrush on the grasslands of the Southern Great Plains.

For mesquite in west Texas, the scientists used two-thirds pound of the ester form of 2,4,5-T in five gallons of a 20 per cent oil emulsion. Control was achieved for about $3 an acre. The kill is 98 per cent for the tops of the brush and more than 50 per cent of the roots. The chemical has given 65 per cent kill when applied as a ground spray to mesquite foilage and up to 90 per cent kill when used to treat the cut surfaces of stumps. Spray applications to the lower 12 inches of the trunk have killed both tops and roots.

### Mesquite Causes Heavy Losses

Economically, the mesquite tree is blamed for costing Southwestern cattlemen millions of dollars annually. Its spread throughout the rangelands has crowded out grass and other plants that provide feed for cattle. Equally important, its dense growth has obscured the cross-country vision of riders, resulting in the missing of thousands of head of cattle at round-up time.

Control of mesquite has been very difficult in the past. Experience with mechanical destruction of mesquite shows that this method does not assure eradication of the brush. In addition to its extensive root system, mesquite has an underground bud-zone from which a score or more new sprouts may shoot up when the tree top is injured. A damaged tree often produces a thicket within a few years.

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The Du Pont Company offers 2,4,5-T in several forms. For airplane spraying of mesquite, it recommends the material in a low-volatility formulation called 2,4,5-T Ester Brush Killer. Recommended airplane spray should contain one and one-third to one and a half pints of the brush killer in solution with three gallons of water and a gallon of oil, such as clear diesel oil, per acre sprayed. The material is available in one-gallon cans, or in five-gallon or 50-gallon drums.

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## NODULAR WORMS IN SHEEP

During World War II when importations of sheep intestines from Australia had to be discontinued, some fear was expressed by the War Department that sufficient sheep casings might not be available for making surgical sutures due to the prevalence of nodular worms in our native sheep. At that time about 25% of all sheep casings had to be tanked as unusable for sutures because of the damage done by nodular worms in the intestines. The U.S. Department of Agriculture and the various agricultural colleges put on a campaign showing sheep owners how they could rid their flocks of nodular worms by feeding phenothiazine. In areas where this practice has been followed the damage done by nodular worms has been greatly reduced.

---Dr. D. H. LeGear

(Reprinted from October, 1950, issue of SOUTHERN PHARMACEUTICAL JOURNAL, Dallas, Texas.)

## DDT WETTABLE POWDER IN NEW FORMULATION NOW AVAILABLE

A new DDT formulation for use in preparation of sprays to protect agricultural crops from a variety of insect pests is now being made by the Du Pont Company.

Known as "Deenate" 75-W DDT insecticide, it is a wettable powder containing 75% technical DDT. It supplants a 50% DDT wettable powder, previously offered by the Du Pont agricultural chemicals section.

The new DDT formulation is being advanced as a more efficient product for farm use. Extensive field tests with the 75% material indicate it will produce a higher deposit of DDT on sprayed surfaces, with less visible residue. From the standpoint of convenience, it will require less storage space, for more of the compound is active insecticide. This also will mean a lower poundage of the material will be required per 100 gallons of spray to supply the same percentage of DDT.

The 75% formulation has also been proven to have the same suspensible and wettable qualities as the former 50% material. It is offered in a wide range of small package sizes, from one to seven pounds capacity, and in 50-pound bags.

For dust mixers, "Deenate" 75-P DDT insecticide has replaced the 50% material formerly offered. It is sold in 50-pound bags.

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## NYLON PLASTIC USED IN BLOOD TRANSFUSION SET

Another important medical use has been found for nylon plastic. Recently employed in the surgical treatment of arthritis, nylon is now being used in a new all-plastic blood and plasma infusion set produced for hospital use by the Cutter Laboratories of Berkeley, Calif.

This development follows reports in medical literature of the use of the Du Pont plastic, "Alathon" polythene resin, in making surgical repairs to various parts of the body.

In the latest case, nylon monofilaments, or solid strands of the plastic, are used in making filters for the infusion sets. Filtering for removal of all clots is important in administering blood or plasma. The complete set is composed of flexible plastic tubing; a nylon needle adapter ready for insertion of the infusion needle; and a double nylon filter, encased in a plastic cylinder which is fitted directly into the blood or plasma flask.

During the infusion, blood flows from the flask through a slotted strainer at the top of the cylinder into a secondary filter of large nylon mesh, and a third, or inner, nylon filter of fine mesh.

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## "AMMATE" WEED KILLER USED FOR PERSIMMON TREE CONTROL

MELBOURNE, Arkansas -- Five hundred pounds of "Ammate" weed killer were distributed in Izard County last year for the control of persimmon sprouts in pastures.

County Agent J. B. Ferguson said that "Ammate" had done a good job of clearing grazing areas.

"Just cutting down persimmon bushes doesn't do much good," Mr. Ferguson explained. "Because of the persimmon's resprouting ability, you soon have three of the bushes where you only had one before." "Ammate" checks this sprouting of persimmons and other undesirable trees.

A recent release from the University of Arkansas College of Agriculture Extension Service cited the case history of L. E. Atkinson of Gid.

### How Chemical Was Applied

He gets a 50-pound drum of "Ammate" from the Farm Bureau at 20 cents per pound. When he cuts bushes, he sprinkles some "Ammate" on the stumps to keep them from sprouting. He also uses it on trees along creek banks and other out-of-the-way places. He treats these trees by applying "Ammate" crystals in cups which are cut near the base of the tree. He said he has found the treatment highly successful.

Of the 500 pounds of "Ammate" distributed in Izard county by the Farm Bureau in 1950, most of it was used to kill persimmon bushes in pastures, preparatory to getting them in shape for mowing. Once the stump is killed, it decays rapidly and can be knocked off at the ground in a year or two, leaving a clean field, Mr. Ferguson added.

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## FIBER V PLANT TO BE BUILT AT KINSTON, N. C.

Construction of a plant to manufacture a new synthetic textile known as Fiber V is scheduled to start at Kinston, N. C. this spring or early summer.

A 635-acre tract on the Neuse River was purchased in September, 1950. Originally it was intended to build a nylon plant there. Several factors dictated the change.

Extensive market studies have led to the conclusion that Fiber V should be put in commercial production at once. It was also decided that the additional nylon yarn capacity, planned originally for the Kinston project, can best be provided, under the present construction materials situation, through technological improvements in production facilities and expansion at existing Du Pont nylon yarn plants. They are at Seaford, Del., Martinsville, Va., and Chattanooga, Tenn.

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## MANY ELEMENTS PLAY PART IN WAR AGAINST PLANT DISEASE

Many forces are cooperating "to form a great team against plant diseases", Dr. J. M. Bickerton, an agricultural specialist of the Du Pont Company at Houston, Texas, wrote in the November, 1950 issue of "FARM AND RANCH -- SOUTHERN AGRICULTURIST", published at Nashville, Tenn.

In an article entitled "The Friendly Fungicides", he pointed out that when a new fungicide is found, it is only the beginning of the process of making it available to the farmer for effective plant disease control.

"Farm machinery manufacturers are playing an important part in this war on plant diseases," he said, pointing out how modern speed sprayers and boom equipment have speeded up the work of dusting or spraying fields, and cut labor costs through increased efficiency. "The airplane," he added, "has become standard equipment in some areas. These forces combine with the chemical industry, the county agent, the food packer, and the grower who cooperates through practical field tests of new products, to form a great team against plant disease. The score they make will be tallied in dollars and cents...through bigger and better profits."

### Fungicides Widely Used in Texas

Texas growers are increasingly depending on fungicides for control of diseases on many crops, Dr. Bickerton continued. He said that potatoes in the Panhandle and South Texas would be a "sad failure" if both early and late blight could not be controlled. Texas lettuce growers -- who have an annual production goal of 2,500,000 crates -- depend on fungicides for control of downy mildew. Citrus melanose is a disease that presents a serious threat to the South Texas citrus industry, but has been kept under control with fungicides. Carrot fields in the Rio Grande Valley, he said, have been saved from severe blight damage by fungicides.

Dr. Bickerton cited the experience of a large tomato grower in the Rio Grande Valley, who harvested an average of 5,864 pounds of tomatoes per acre on a treated field in the spring of 1949. In another field, where the tomatoes had fallen prey to early blight and gray leaf spot, the yield averaged only 2,480 pounds of marketable tomatoes per acre. "The net additional profit was $66.67 per acre", Dr. Bickerton said.

### Control of White Rust and Blue Mold

The author cited the success of fungicides in the spinach fields in the vicinity of Eagle Pass and Crystal City, Texas, in the winter of 1949-50, where the white rust and blue mold inroads were so pronounced that some growers made no attempt to harvest some of the fields. Others, however, did treat their fields with fungicides, harvesting an average of 6-1/2 tons of marketable spinach per acre, as compared with less than two tons per acre in adjoining fields where

fungicides were not applied. The increase in income, Dr. Bickerton said, amounted to more than $340 an acre in treated fields, thus showing that the fungicides were "worth many times their cost by turning loss into profit."

Although more and more is being learned about plant diseases and the role of fungicides in preventing them, there is still considerable confusion on the subject. One reason is that bugs -- which are controlled by insecticides -- are easy to see, but it is difficult to understand diseases. Another reason may be that the stories about the spectacular results achieved with chemical insecticides and weed killers have been broadcast so far and wide in the past few years that people are apt to overlook the fungicides. Dr. Bickerton reports that even some large-scale growers are confused about the difference between chemicals to kill insects and those to protect against disease.

Since seeds are also subject to fungus infections, Dr. Bickerton draws attention to the fact that the popularity of treating seeds with chemicals has greatly increased in the past few decades.

## Diversified Research Helped Find Fungicides

The role that large organizations, working in more than one field of endeavor, played in developing some of the fungicides now widely used is described by Dr. Bickerton.

In the early 1930's Du Pont's biological laboratories were seeking new and more effective fungicidal materials. In that connection their researchers went to another Du Pont laboratory and obtained organic compounds used in industrial fields. They were then tried out in the biological laboratory -- and the fungicidal action of some of them was surprising. Thus were the dithiocarbamate fungicides discovered. (*)

The development of the dithiocarbamates as fungicides illustrates the advantages of research by a large company, which has a wide range of interests. Because of its diversity, it can recognize the value of new developments which otherwise might remain unknown. The biological group in Du Pont has constant access to chemicals developed for other uses by other departments in the company. It therefore has a greater than average chance of findinng a chemical that will work in the field of agriculture. This is what happened when an industrial chemical turned out to be good for agriculture.

To simplify matters for users of these products, they have been given short "common" or generic names, and the manufacturers have also given them trade names, such as "Fermate" fungicide, "Arasan" seed disinfectant, "Tersan" fungicide, "Parzate" fungicide, and "Zerlate" fungicide.

(*) For more information on this cooperative research, see "Derivatives of Dithiocarbamic Acid as Fungicides" by Dr. Wendell H. Tisdale and Dr. Albert L. Flenner, both of Du Pont, in the November-December, 1950, issue of the AGRICULTURAL NEWS LETTER.

## FELLOWSHIPS AND GRANTS TO HELP STOCK-PILE KNOWLEDGE ANNOUNCED

The award of 78 post-graduate and post-doctoral fellowships to 47 universities, and grants-in-aid to 10 universities to "stock-pile" knowledge through the advancement of fundamental research has been announced by the Du Pont Company.

An authorization of $390,400 was provided for these awards. They are for the 1951-52 academic year.

Granting of the fellowships is a continuation of the plan originated in 1918 to encourage graduate research in chemistry. It has since been expanded to include other fields. It is expected that the program will help maintain the flow of technically trained men and women into teaching and research work at universities and into technical positions in industry.

The grants-in-aid to universities are for unrestricted use in the field of fundamental chemical research. They provide $10,000 for each of 10 universities, all of which received similar awards for the present school year. The company also provided $20,000 to the University of Chicago for membership in its Institute for the Study of Metals for 1951.

### Freedom In Selection of Research Topics

The universities themselves select the research projects for which the grants will be used, the only stipulation being that they be free from any commercial implications at the time the work is initiated.

Institutions which will receive $10,000 grants each are: California Institute of Technology, Cornell University, Harvard University, University of Illinois, Massachusetts Institute of Technology, University of Minnesota, The Ohio State University, Princeton University, University of Wisconsin, and Yale University.

Each of the post-graduate fellowships provides $1,400 for a single person or $2,100 for a married person, together with an award of $1,200 to the university, for the next academic year. Each of the post-doctoral fellowships provides $3,500 for the recipient and a grant of $1,800 to the university.

Of the 72 post-graduate fellowships to be awarded, all of which are pre-doctoral, 45 are in chemistry, 15 in chemical engineering, 5 in mechanical engineering, 3 in physics, 2 in metallurgy, 1 in biochemistry and 1 in biology. The six post-doctoral fellowships are for work in chemistry.

## Universities Receiving Fellowships

Post-doctoral fellowships in chemistry were awarded to Cornell University, Harvard University, Massachusetts Institute of Technology, University of Illinois, University of Minnesota, and University of Wisconsin.

Post-graduate fellowships in chemistry were awarded to Brown University, California Institute of Technology, Carnegie Institute of Technology, Columbia University, Cornell University, Duke University, Harvard University, Iowa State College, The Johns Hopkins University, Massachusetts Institute of Technology, Northwestern University, The Ohio State University, Oregon State College, The Pennsylvania State College, Polytechnic Institute of Brooklyn, Princeton University, Purdue University, Rutgers University, Stanford University, Syracuse University, Washington University of St. Louis, Western Reserve University, Yale University, University of California at Berkeley, University of California at Los Angeles, University of Chicago, University of Colorado, University of Delaware, University of Illinois, University of Indiana, University of Iowa, University of Kansas, University of Maryland, University of Michigan, University of Minnesota, University of Missouri, University of Nebraska, University of North Carolina, University of Notre Dame, University of Pennsylvania, University of Rochester, University of Texas, University of Virginia, University of Washington (Seattle), and University of Wisconsin.

Post-graduate fellowships in chemical engineering were awarded to Carnegie Institute of Technology, Columbia University, Cornell University, Massachusetts Institute of Technology, The Ohio State University, Princeton University, Yale University, University of Delaware, University of Illinois, University of Michigan, University of Minnesota, University of Pennsylvania, University of Tennessee, University of Texas, and University of Wisconsin.

Fellowships in mechanical engineering were awarded to Columbia University, Lehigh University, Massachusetts Institute of Technology, The Pennsylvania State College, and Purdue University.

Fellowships in physics were awarded to The Ohio State University, University of Virginia, and Yale University. Fellowships in metallurgy were awarded to Carnegie Institute of Technology and Lehigh University.

The fellowship in biology was awarded to the California Institute of Technology and the one in biochemistry to the University of Wisconsin.

## WHAT'S HAPPENED IN 25 YEARS OF AGRICULTURAL CHEMICAL DEVELOPMENT -- AN INFORMAL REVIEW

By R. M. Roberts

Some day, when you're using DDT or methoxychlor or benzene hexachloride, stop and think back of those historic and often discouraging battles with the bugs, waged with Paris green, Persian insect powder, and the other materials of the insecticide trade a quarter-century ago.

One man who remembers what took place in the agricultural chemical picture much farther back than 1925 is Dr. Harry F. Dietz, manager of the Du Pont Company pest control laboratory at Wilmington, Del. To use his own phrase, Dr. Dietz "grew up with and participated in the development of insecticides and fungicides from the day of home-boiled and self-boiled lime-sulfur!"

Harry Dietz, a high school boy in the days just after the 20th century roared in, spent his summer vacations working for the Office of the Indiana State Entomologist on the pump handle of the then commonly used barrel sprayer, or at the end of the long and heavy 12-foot spray rods.

"San Jose scale was still ravaging Eastern fruit orchards," he recalls. "Illinois blister canker was wiping out many of the old Ben Davis orchards. Codling moth and apple scab were beginning to be recognized as the major insect and disease, respectively, attacking apples."

### Arsenicals Predominated 25 Years Ago

A lot of water has flowed through the irrigation weirs in the span of years between then and our modern era of residual insecticides, dithiocarbamate fungicides, seed treatments, soil fumigants, hormone sprays, and weed killers. Maybe you'll enjoy, as I did, sitting down with Dr. Dietz and charting the changes of major importance that have taken place in the agricultural chemical field.

Let's look first at the shelves of a well-stocked farm supply dealer of 25 years ago. Most in demand as insect controllers then were the arsenicals -- Paris green, lead arsenate, calcium arsenate.

The first lead arsenate was produced as a paste by a patented electrolytic process in 1906. This was followed very shortly by a cheaper, improved method using arsenic acid and a lead compound, litharge, in a strictly chemical process.

In February of 1907, the Grasselli Chemical Company (now the Grasselli Chemicals Department of Du Pont) began manufacturing lead arsenate.

## Fluorine Compounds Enter the Picture

By 1925, however, growers were beginning to look for a more effective material. Appearing on dealers' shelves were the first of the fluorine compounds, sodium fluoride and sodium fluosilicate, both recommended at first as moth sprays. These were followed by such insecticides as cryolite and barium fluosilicate.

Also available as bug destroyers were several other chemicals. A new one in that period was paradichlorobenzene, suggested primarily for control of clothes moths and peach tree borer. Nicotine sulfate and free-base nicotine were on the market, intended as aphicides but used commonly for almost any insect. And the pyrethrum powders were just making a name for themselves. They appeared as the famous Persian insect powder for use on crops, and in oil-base fly spray preparations.

Among the fungicides 25 years ago, lime-sulfur was still popular. There also was quite a revival of oil sprays to control scale and mites, particularly among the citrus groves. Power spraying equipment had first appeared around 1920.

Bordeaux mixture was selling well to the growers 25 years ago as a disease-control material, although a lot of copper sulfate and lime was being sold separately for home mixing. The sulfurs were quite popular then, too. The common dusting sulfur was most in evidence. Flotation sulfur paste was just appearing on the scene, as was the first of the wettable sulfur products.

## New Seed Disinfectants Introduced

By 1925, the first two of the revolutionary mercurial compounds for seed treating were on the market. They were the German product Uspulun, for liquid treatment, and the original Bayer-Semesan, for both liquid and dust treatment.

At that time, oil sprays were the latest word to kill wild onion. For mustard and other broad-leaf pests, iron sulfate and copper sulfate were thought to be pretty fair controls. Also in use were common salt, sodium chlorate, sodium arsenite, sodium arsenate, and even sulfuric acid.

By 1928, you could take your choice from a number of the fluorine sprays. Remember barium fluosilicate, sodium fluosilicate, and sodium fluoaluminate, this latter better known as cryolite? Another new one of that era, designed to replace the nicotines both as fly sprays and plant sprays, was a long-chain alkyl thiocyanate. There were a couple of new arsenicals, too -- magnesium arsenate and manganese arsenate.

In the early 1930's, real progress could be noted in the crop protection campaign. Mexican bean beetle was the major scourge of the country and in

1932 the best control of this pest up to that time was introduced -- rotenone! New formulations of the pyrethrum sprays were also appearing and were assuming major importance in the insecticide field.

## Copper Fungicides Introduced In Depression

In the fungicide field of the early depression days, a deluge of new copper products hit the market. The family of cuprous oxides made their appearance with red copper oxide leading the parade. Basic copper sulfate, copper oxychloride, copper silicates, and copper phosphates were available. It was during this period that Du Pont's Copper-A fungicide was introduced and began performing feats of disease prevention in vegetable crops which have assured its popularity to the present day.

The Japanese beetle was first found near Riverton, N. J., in 1916. By the late '30's this pest had pretty well swept the major agricultural areas of the Eastern United States. Anything that gave promise of insecticidal action was being tested. The Du Pont Company had developed a group of compounds being used in the rubber industry to accelerate the vulcanization process. These now came under scrutiny as tools in the Japanese beetle offensive, and thereby hangs an interesting tale.

## How "Arasan" Seed Disinfectant Developed

One of these products, tetramethyl thiuram disulfide, was offered briefly as a "feeding inhibitor" -- a sort of repellant to keep the bugs off the crops. However, it was too expensive for this purpose. Today, however, it is known far and wide as "Arasan" seed disinfectant.

Another of these rubber accelerators was an iron salt, still another a zinc salt -- both of the dithiocarbamate family. Both were found quite effective at keeping beetles away from crops, if not at actually killing the pests. The iron compound was sold as FDDC and the zinc compound was commonly known simply as Zinc Salt. Today we know the former as "Fermate" fungicide and the latter as "Zerlate" fungicide -- two of the remarkably effective new organics.

Phenothiazine was another insecticide on the market in this period, but it is no longer thought of as a bug killer, since it has won much greater fame in another field. Phenothiazine was not highly effective against the Japanese beetle, but when it showed promise as a treatment to rid livestock of internal parasites, no one cared about its beetle-killing potentialities. It won rapid acclaim from the livestock industry and has saved millions of dollars and thousands of sheep and cattle for stockmen.

This was the time, too, when the dinitro compounds were developed as dormant sprays in orchards -- weapons against the rosy aphis and other pests that can be attacked during the leafless months.

## Flame Retardant Effective in Killing Weeds

Ammonium sulfamate had been discovered as a flame retardant. It was tested as a weed killer and today we know it as "Ammate" weed killer. It controls poison ivy and is valuable as a non-selective brush killer which is both non-flammable and safe to use in areas where livestock graze.

Also, just before World War II, a lot of work was being done in the brand new field of plant hormones. The effects on plants of indolebutyric acid, indoleacetic acid and napthalene acetic acid were being observed, and in 1938 the first commercial product to result from these experiments was ready for the market. Called "Parmone" pre-harvest fruit drop spray, it found a firm place in the agricultural scene as a preventative of premature fruit drop. Plant hormones also came into use as an aid in the rooting of cuttings, to prevent the defoliation of holly cut early for the holiday trade, and for various other purposes.

## DDT Makes Insecticide History

Then came the war and a lot of things happened. The development that made the biggest splash in insecticide history was undoubtedly DDT. A German scientist named Othmar Zeidler first produced DDT in 1874 and painstakingly set down the method by which it could be produced in the laboratory. But his notes were left to gather dust until they were unearthed in the late '30's by the Geigy Co. of Switzerland. They produced DDT, applied for a Swiss patent in 1940 and marketed it as a moth-proofing material.

DDT might still only be keeping moths out of Swiss overcoats had it not been for a troublesome American visitor -- the Colorado potato beetle! Swiss crops were being overrun by the pest and in seeking some better insecticide to deal with this invasion, one of the Geigy investigators applied the new moth-proofing material, DDT, to a farmer's field. The results were remarkable. Not only did the beetles die, but they kept dying for weeks after the application.

By this time, GI's and Marines were going overseas by the shipload. Medical officers of our armed forces were looking for an insecticide which would protect the health of the troops from vermin and disease-spreading bugs of South Pacific islands and bombed-out towns in southern Europe and northern Africa. They learned the amazing Swiss story of DDT, arranged with Geigy for the licensing of an American producer of the material, and asked the Du Pont Company to go into production on this wartime essential.

## Europe Contributes Other Chemicals

Parathion, TEPP, and some of the other new organic phosphorous insect killers were war-inspired materials from the other side of the lines. They were produced by the German chemical industry as poisons for war use. Fortunately, they were never employed against our forces.

BHC (benzene hexachloride) was another war product. When insecticides they customarily imported were shut off by the enemy submarine blockade, British farmers were in the dire position of facing a loss of the majority of their crops. Indeed, this situation might easily have been grave, had it not been for the development of BHC by the British chemists.

Wartime also saw the development of the selective weed killer, 2,4-D, along with the newer 2,4,5-T and other of the modern hormone weed killers, enabling the farmer to kill broad-leaf weeds without damaging the narrow-leaf crop they were infesting. With this start, the progression to TCA, a selective killer of grass-type weeds has been a logical step.

## Need For Safe Chemicals Is Emphasized

Even before V-J day, American agriculture was fast learning to use some of these potent tools to protect crops. But the very possession of such toxic materials emphasized an even more pressing need. That need has been pointed out by federal tolerance hearings conducted by the Food and Drug Administration last year to determine the amount of residue at harvest time from various insecticides and fungicides which may be allowed, and still protect the health of the consuming public.

And reflecting this concern for public health, there is a pronounced trend within the chemical industry to seek new pest control compounds which will be deadly to the insects, yet will be safer to use and safe to apply close to harvest time.

One such development has been methoxychlor, a compound which was first formulated in a Du Pont laboratory in 1942, yet only gained public attention in 1949, after the toxic hazards from improper use of DDT became known. In addition to its extremely low toxicity to warm-blooded animals, methoxychlor has also demonstrated another admirable quality, so far as the vegetable grower is concerned. It possesses a very low order of phytotoxicity. This has made it possible to apply this potent insect killer to such sensitive plants as cucumbers and melons, without suffering the leaf-burn and other plant damage which harsher insecticides inflict.

Here is a pattern to be followed and improved upon as other insecticides and fungicides are developed for the protection of future crops. This is your clue to the future of agricultural chemicals into which Dr. Dietz and his fellow research workers are looking as they develop new products and test them in greenhouses and field trials, always with the cooperation and assistance of federal and state experimental stations and investigators throughout the country.

## DU PONT IS BUILDING ADDITIONAL MANUFACTURING UNITS IN SOUTH

The development of an improved process for the commercial production of hydrogen peroxide, an increasingly important industrial chemical, has been disclosed by E. I. du Pont de Nemours & Company.

Du Pont announced it would build its first production unit at Memphis, Tenn., at the same site where it is building a unit for the production of sodium cyanide.

Du Pont long has been a producer of hydrogen peroxide at plants in Niagara Falls and Dresden, N. Y. The improved process represents the culmination of six years of research.

Hydrogen peroxide is widely used in the textile, paper, and rubber industries. It is important to the textile industry for the bleaching of cotton, wool, silk, rayon, linen, and other natural and synthetic fibers. Du Pont, within the last ten years, has developed its use extensively as a bleach for paper pulps.

### Local Authorities Consulted on Pollution Problems

The new facilities will be operated by the Electrochemicals Department. They will be located on a 225-acre site 10 miles north of the Memphis business district, and completion is scheduled before the end of 1952.

The new units will be of the modern open-air type of construction. Most of the equipment will operate in the open, with controls located in small buildings. Offices and service facilities will be in buildings constructed of concrete, brick, and steel.

All buildings and equipment were designed with the highest consideration for safety and comfort of the employees. Complete waste control equipment will be installed, so that there will be neither water nor air pollution. Du Pont's policy is to meet all such problems in the design stage, and no plans are complete until every possible pollution problem has been worked out with full consultation with state and local agencies.

### Former Co-Op Building to be Sponge Factory

At Columbia, Tenn., the Du Pont Company has bought buildings formerly used by a farmer's co-operative for conversion into a cellulose sponge plant. The co-op is now operating in new quarters.

The property was the storehouse and auxiliary buildings of the Morris County Farmers' Co-op. They were built for the federal government in 1944 for production of activated charcoal for gas masks but were never used for that purpose. After the war they were bought by the farmers' co-op, which used the facilities for grain storage.